DRUG CALCULATIONS

HOW TO SOLVE DRUG CALCULATIONS

- **Identify what type of drug calculation** and as a first step, **use common sense to estimate a rough answer.** In many cases, drawing a picture that visually represents the problem is often a helpful strategy.
- Remember that a formula often used for working out how many **tablets** to take or for a **drug taken orally** or **injected** is:

$$\text{VOLUME REQUIRED} = \frac{\text{STRENGTH REQUIRED (SR)}}{\text{STOCK STRENGTH (SS)}} \times \frac{\text{VOLUME OF STOCK}}{1}$$

TIP: An easy way to remember this formula is **SUNRISE (SR) / SUNSET (SS)**

- Remember that a formula often used to work out the number of drops per minute delivered by an **intravenous infusion** is:

$$\text{DRIP RATE (DPM)} = \frac{\text{VOLUME (mL)} \times \text{DROPS/mL}}{\text{TIME (h)} \times 60}$$

NOTE: DPM stands for ***drops per minute***

- Remember that for **intravenous infusion,** sometimes you are asked to calculate volume, time, or rate, and the following formulae can be useful:

$$\text{VOLUME (mL)} = \text{RATE (mL/h)} \times \text{TIME (h)}$$

$$\text{RATE} = \frac{\text{VOLUME (mL)}}{\text{TIME (h)}} \qquad \text{TIME} = \frac{\text{VOLUME (mL)}}{\text{RATE (mL/h)}}$$

- After applying the formula (if relevant), or calculating an exact answer using common sense, go back and check: is your final answer close to your initial estimate? If not, why not?

EXAMPLE 1: DRUG MADE UP FROM STOCK SOLUTION

This example illustrates how to work out injections or orally taken drugs made up from stock solution – for example, working out how many mLs to inject when the drug is in a stock solution.

QUESTION: ***A patient is ordered 70 mg of pethidine. Find the volume required if the stock solution contains 10g of pethidine per 200mL.***

TO SOLVE: We'll be using this formula:

$$\text{VOLUME REQUIRED} = \frac{\text{STRENGTH REQUIRED (SR)}}{\text{STOCK STRENGTH (SS)}} \times \frac{\text{VOLUME OF STOCK}}{1}$$

VISUAL REPRESENTATION

1. Note down the strength of medication the patient needs and the stock strength:
   Strength Required is 70 mg, **Stock Strength** is 10g in 200 mL

   At this point our rough answer is – More than 1 mL and a lot less than 200mL.
2. Since you need units to be the same, convert 10 g to mg by multiplying by 1000.
   e.g. 1000mg x 10 = 10,000mg (10,000mg = 10g)

CONVERSION TIP:
X 1,000
g ⇄ mg
÷ 1,000

3. Now put the values into the above for.
   Note that 70mg (what the patient needs) is a very small part of 10,000mg – so expect your answer in mL to be much less than 200mL

$$\text{VOLUME REQUIRED} = \frac{70}{10000} \times \frac{200}{1}\text{mL} = \frac{14000}{10000} = \frac{14}{10}\text{mL} = 1.4\text{mL}$$

ANSWER: Based on the above, your answer = **1.4mL**

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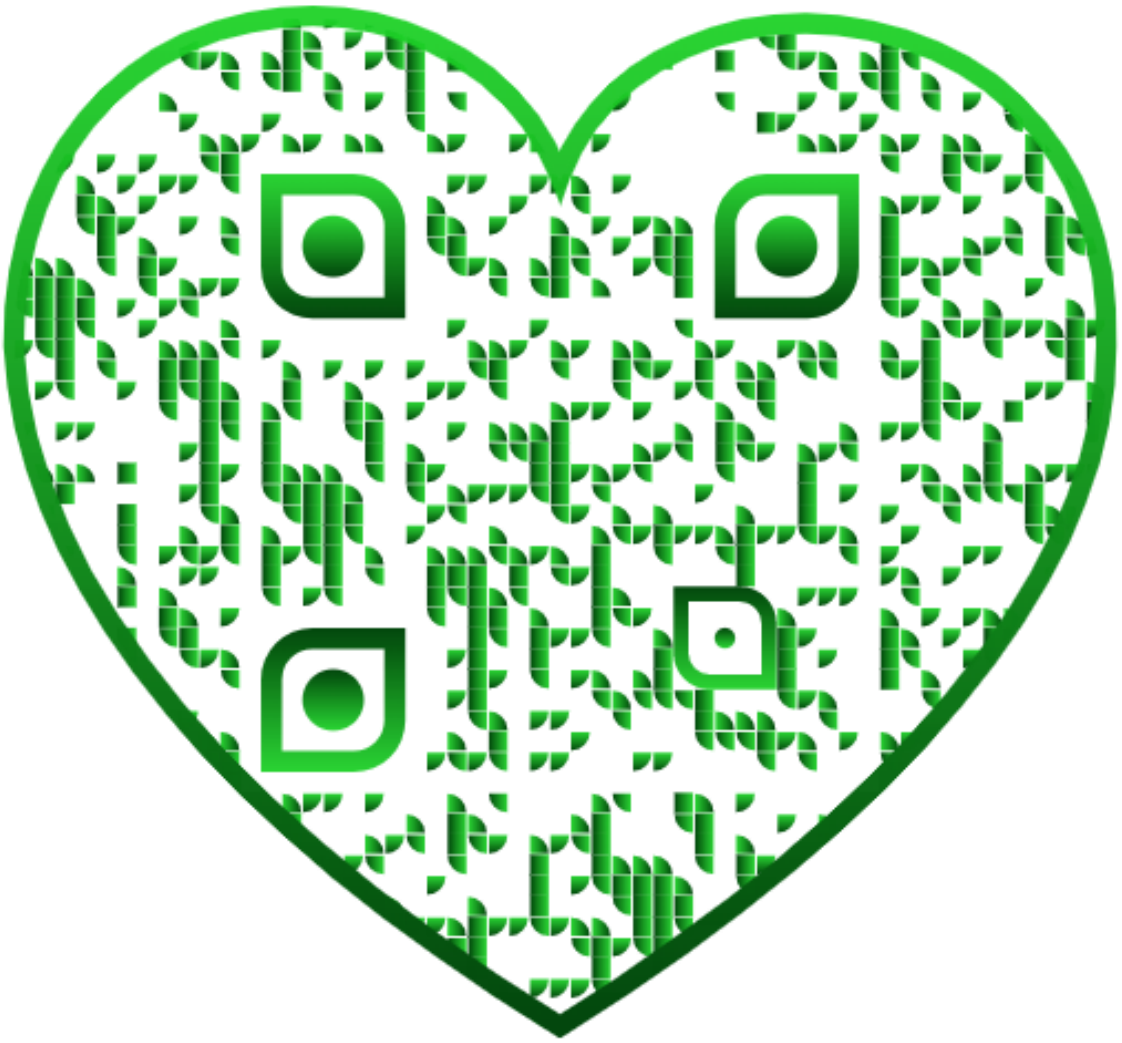

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EXAMPLE 2: INTRAVENOUS INFUSION

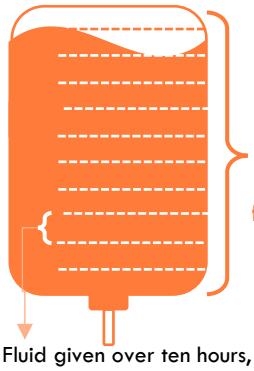
This example indicates how many mLs to give in a certain time, and how many drops per minute a patient will receive.

QUESTION: A teenager who is badly dehydrated is to receive 1.5 L over 10 hours of rehydration fluid by IV infusion. The giving set delivers 20 drops/mL. Calculate the drip rate.

TO SOLVE: We'll be using this formula – remember that DPR stands for '*drops per minute*'

$$\text{DRIP RATE (DPM)} = \frac{\text{VOLUME (mL) x DROPS/mL}}{\text{TIME (h) x 60}}$$

VISUAL REPRESENTATION



Fluid given over ten hours, so each of these small sections represents fluid given in one hour (150 mL or 0.15 L)

1. Note down the key figures in the above scenario
   Volume is 1.5 L, **Drops/mL** is 20 and **Time (h)** is 10

   Rough answer? Since the drops per mL is **20**, and there are **60** minutes in an hour, you'll calculate an answer in drops per mL by multiplying the fluid per hour by 20/60 = 1/3. So one-third of your mL per hour (150 mL) should be your answer – i.e. 50 mL.

2. Notice units of rehydration fluid **(L)** different from giving set **(mL)**, so convert 1.5L to mL by multiplying by 1000: *e.g. 1.5 x 1000 = 1500 (1,500mL = 1.5L)*

CONVERSION TIP:
X 1,000
L ⇄ mL
÷ 1,000

3. Put the values into the above formula:

$$\text{DRIP RATE (DPM)} = \frac{1500\text{mL} \times 20}{10 \times 60} = \frac{150 \times 2^{\div 2}}{1 \times 6^{\div 2}} = \frac{150 \times 1}{1 \times 3} = \frac{150}{3} = 50 \text{ dpm}$$

ANSWER: Based on the above, your answer = **50 dpm** (which matches the initial estimate)

EXAMPLE 3: TABLETS TAKEN ORALLY

This example illustrates how to calculate how many tablets to give for a certain dose.

QUESTION: 750 mg of ciprofloxacin is prescribed. On hand are 500 mg tablets. How many tablets should be given?

TO SOLVE: We'll be using this formula:

$$\text{VOLUME REQUIRED} = \frac{\text{STRENGTH REQUIRED (SR)}}{\text{STOCK STRENGTH (SS)}} \times \frac{\text{VOLUME OF STOCK}}{1}$$

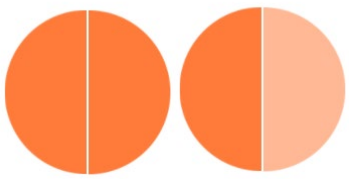
1. Note down the key figures in the above scenario – the units are the same so we won't need to convert
   Strength Required is 750 mg, **Stock Strength** is 500mg

   Rough answer? Tablets are 500mg so we'll need more that one tablet but less than two.

2. Put the values into the above formula
   Note – when administering tablets, the volume of stock is always 1, since the tablets are not supplied in a solution.

$$\text{VOLUME REQUIRED} = \frac{750}{500} \times \frac{1}{1} = \frac{750}{500} = \frac{3}{2} = 1.5 \text{ tablets}$$

VISUAL REPRESENTATION



Each tablet is 500mg, since that is the stock strength. As the strength required is 750mg (500mg + 250mg), and half of 500mg is 250mg, the patient will need 1.5

ANSWER: Based on the above, your answer = **1.5 tablets**

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EXAMPLE 5: INTRAVENOUS INFUSION

This example illustrates how to calculate how much fluid a patient receives.

QUESTION: ***A patient is receiving 100 mL/h of a solution for 1.5 hours. How much fluid are they receiving?***

TO SOLVE: Note, you're asked for the **volume** of fluid (how many mL the patient gets in total), rather than the drip rate, so we'll be using the below formula:

VOLUME (mL) =RATE (mL/h) x TIME (h)

1. Note down the key figures in the above scenario
   Rate is 100 mL/h, **Time** is 1.5h

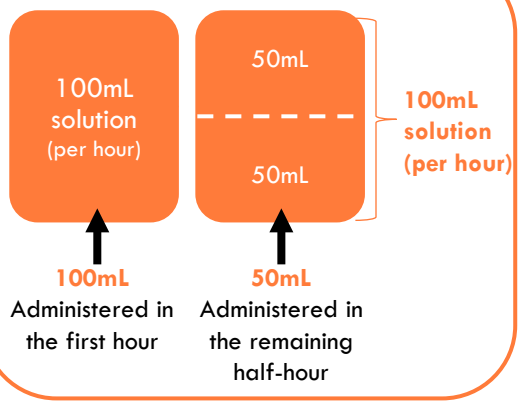
   Rough answer? If the patient gets 100 mL in an hour they would get half of that (50 mL) in half an hour so expected answer is 150 mL.

2. Put the values into the above formula:

VOLUME (mL) =100mL x 1.5 = 150mL

ANSWER: Based on the above, your answer = **150mL** (which matches the initial estimate)

VISUAL REPRESENTATION



EXAMPLE 5: INTRAVENOUS INFUSION

This example illustrates how to work out how long an infusion will take.

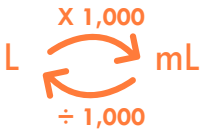
QUESTION: **A patient is prescribed 2 L of a dextrose saline solution. The flow rate is set at 160 mL/h. How long will the infusion take?**

TO SOLVE: We'll be using this formula:

$$\text{TIME} = \frac{\text{VOLUME (mL)}}{\text{RATE (mL/h)}}$$

1. Note down the key figures in the above scenario
   Volume is 2 L, **Rate** is 160mL/h

CONVERSION TIP:



2. Notice units of saline (L) different from mL used in flow rate, so convert 2 L to mL by multiplying by 1000. *e.g. 2 x 1000 = 2000 (2,000mL = 2 L)*

   Rough answer? Since 2 L = 2000 mL and the flow rate is 160 mL per hour, you need to work out how many lots of 160 mL add up to 2000 to get your answer. A rough guess could be between 10 and 15 hours.

3. Put the values into the above formula

$$\text{TIME} = \frac{2000}{160} = \frac{200^{\div 4}}{16^{\div 4}} = \frac{50^{\div 2}}{4^{\div 2}} = \frac{25}{2} = 12.5 \text{ hours}$$

VISUAL REPRESENTATION

The question is asking, how many lots of 160mL taking (1 hour each) will it take to get 2000mL?

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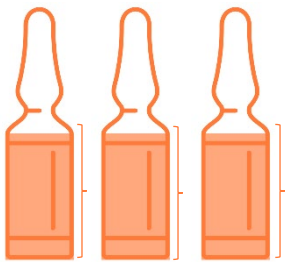
EXAMPLE 6: DILUTION

This example illustrates how to dilute a drug to the required concentration.

QUESTION: Prepare a morphine infusion 30 mg to be made up to a final volume of 30 mLs. Stock ampoules of morphine contain 10 mg/mL. A strength of 1mg/mL is required. How much normal saline would need to be added to the syringe?

TO SOLVE:

1. Note that the stock ampoules of morphine each contain **10 mg** morphine, therefore you will need **3** stock ampoules to get **30 mg** (3 x 10 = 30).
2. Those three stock ampoules come in a total of **3 mL** of solution (1 mL + 1 mL + 1 mL = 3 mL). So, just from your stock, you have **30 mg** morphine in **3 mL** solution.
3. You need **30mg** morphine in **30mL** solution so to top this up, you add **27mL** of saline to the syringe. (30 – 3 = 27)



3x stock ampoules of morphine

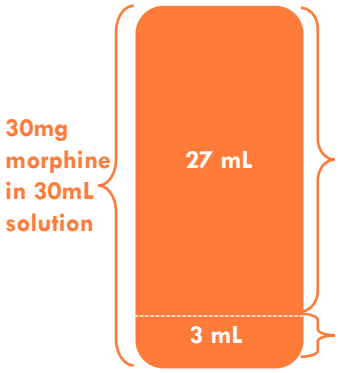
10mg morphine in 1mL solution

VISUAL REPRESENTATION

There is 10 mg morphine in each stock ampoule, so you need 3 stock ampoules (3x10 mg = 30 mg) to get the required 30 mg morphine.

These stock ampoules come in a total of 3 mL of solution (1mL + 1 mL + 1 mL = 3 mL).

Since you need your 30 mg to be in 30 mL of solution, you need to add 30 – 3 = 27 mL saline to the syringe



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EXERCISES

Complete the below exercises to test your skills and see what you've learnt!

EXERCISE SET 1

1. How much is drawn from a patient ordered an injection of 80 mg of pethidine? Each stock ampoule contains 100 mg per 1 mL.
2. A child requires 50 milligrams of Phenobarbitone. If stock ampoules contain 200 milligrams in 2 mL, how much will you draw up?
3. What volume is required for the injection if a patient is ordered 500 mg of capreomycin sulphate, & each stock ampoules contains 300 mg/mL?
4. A patient needs 5000 mg of medication. Stock solution contains 1 g per 1 mL. What volume is required?
5. If 1000 mg of chloramphenicol is given & stock on hand contains 250 mg / 10 mL in suspension, calculate the volume required.
6. A patient is prescribed 3 g of sulphadiazine, the stock contains 600 mg / 5 mL. How much stock should be given to the patient?
7. Complete the following table:

	STRENGTH REQUIRED	STOCK	VOLUME REQUIRED
a)	**1000 U**	**1000 U / 2 mL**	
b)	**1.25 micrograms**	**2.5 micrograms / 1 mL**	
c)	**20 mg**	**100 mg / 50 mL**	
d)	**1 megaunit**	**1 megaunit / 10 mL**	
e)	**4 g**	**1 g / 5 mL**	

EXERCISE SET 2

1. 500 ml is to infuse over a 5 hour period. Find the flow rate in mL/h.
2. Mr Smith is to receive 800 mL of an antibiotic via an IV infusion over 15 hours. Calculate the flow rate to be set.
3. An infusion is to run for 30 minutes and is to deliver 200 mL. What is the rate of the infusion in mL/h?
4. Calculate the flow rate if 1.2 L is to be infused over 24 hours.
5. An order states that 500 mL albumin 5% is to be given in 4 hours. What is the flow rate that should be set?

ANSWERS

SET 1: 1) 0.8mL 2) 0.5mL 3) 1.7 mL 4) 5mL 5) 40mL 6) 25mL
7) a) 2mL b) 0.5mL c) 10mL d) 10mL e)20mL

SET 2 1) 100mL/h 2) 53mL/h 3) 400mL/h 4) 50mL/h 5) 125mL/h

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